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## TWO NEW NEMATODES COMMON IN SOME FISHES OF CAYUGA LAKE \*

MEYER WIGDOR

Very little work has been done in this country on the nematode parasites of fishes. Suitable monographs are available on the nematodes of rodents, ruminants and some domesticated animals, but when the identification of fish nematodes is attempted, resort must be had to foreign literature such as the key to the nematodes in Brauer's *Süsswasserfauna Deutschlands*, Railliet and Henry's many valuable papers, etc. Ward's recent compilation (1918) of freshwater nematodes in "Ward and Whipple's Freshwater Biology," is a very important and valuable aid in the identification of these forms and will undoubtedly give an added impetus for further study along these lines, but much work remains to be done before a really comprehensive monograph on nematodes from freshwater fishes will be possible.

That the study of fish nematodes presents a large and little investigated field in this country is evidenced by the number of new genera and species recently established by workers in this group of fish parasites. Ward and Magath (1917) describe eight new species of nematodes from freshwater fish, three constituting new genera and five agreeing sufficiently with European forms to be listed in already existing genera. The two new species described in this paper both fall within existing genera, one being placed in the genus *Rhabdochona* in the family Thelaziidae of the superfamily Spiruroidea, which superfamily seems to hold a very prominent place among the parasites of freshwater fishes, and the other being placed in the genus *Hysterothylacium* in the family Heterocheilidae of the superfamily Ascaroidea.

### *Rhabdochona cascadilla* Wigdor nov. spec.

*Rhabdochona* is a new genus created by Railliet (1916) in the family Thelaziidae of the superfamily Spiruroidea. He characterizes the family as comprising forms possessing a head, either naked or provided with cuticular expansions or with a cup-shaped covering; the mouth without lips or only two in number and followed generally by an elongated vestibule or a short buccal capsule.

He characterizes the genus as follows: Mouth with two lips, limiting a funnel-shaped cavity which is supported by longitudinal cuticular ribs. Esophagus of medium length and with two distinct parts. Male

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\* Contribution from the Entomological Laboratory of Cornell University.

with a conical tail, pointed and recurved. No caudal alae; numerous simple preanal and postanal papillae. Two unequal spicules. Female with a straight conical, elongated tail. Vulva towards the posterior end of the body. Uteri divergent. Habitat: intestine of freshwater fishes. Type species: *Dispharagus denudatus* Duj. 1845.

In Cascadilla creek, especially at Dwyer's pond, *Rhabdochona cascadilla* was found to be especially common in the small intestine of the horned dace, *Semotilus atromaculatus* (Mitchell) and the cayuga minnow, *Notropis cayuga* (Meek), two minnows especially common in this tributary to Lake Cayuga.

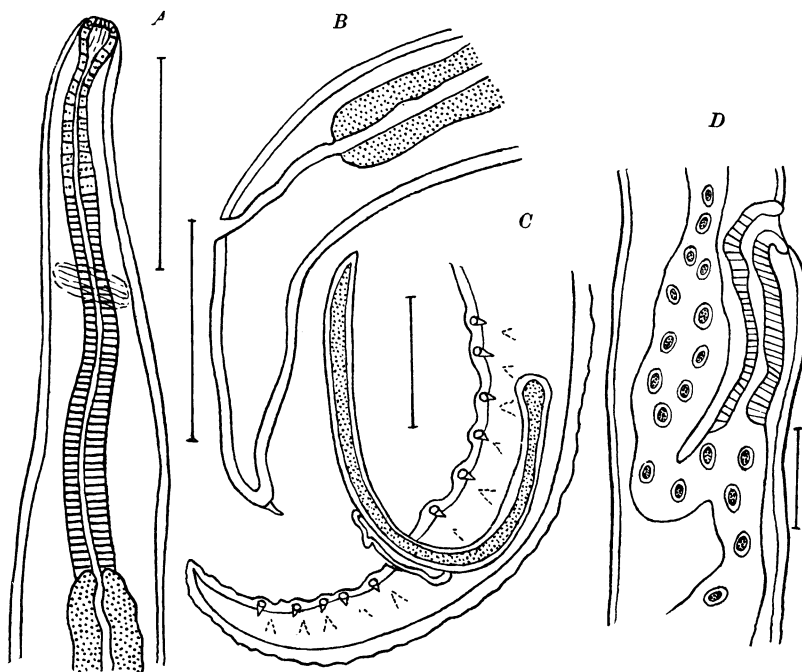
This new species may be briefly characterized as follows: Body filiform, cylindrical, attenuated at anterior end. Head truncated, somewhat rounded and smooth. Mouth possessing two lips terminating a funnel-shaped cavity which is supported by longitudinal cuticular ribs bearing two small, somewhat conical, papillae (Fig. 1). Esophagus distinctly short and made up of an anterior and posterior portion, the former being approximately one-third the length of the latter.

*Male*: 3.01 to 4.11 mm. in length and 0.096 to 0.104 mm. in width at widest part. Length of esophagus 0.24 mm. Distance of nerve ring from anterior extremity 0.115 mm. Spicules very prominent. Large spicule 0.04 mm. in length, pointed and very flexible and generally U-shaped when protruding from body. Small spicule slightly more than one-fifth as long as the large spicule and provided with a blunt, cap-like distal portion. Tail conical, subacute and recurved. Six pairs of preanal, one pair of adanal and five pairs of postanal papillae (Fig. 2).

*Female*: 6.80 to 9.28 mm. in length and 0.096-0.128 mm. in width at widest part. Young immature females 3.8 to 4.06 mm. in length and 0.08 to 0.096 mm. in width. Vulva a transverse slit in posterior portion of the body about five-eighths the total body length from anterior extremity. Ovijector extends 0.18 mm. posteriad of the vulva. Uteri divergent (Fig. 3) and very voluminous, full of developing ova 32 by 16 $\mu$  in diameter, and filling up approximately three-quarters of the body cavity. Uterus bifurcates 0.272 mm. posteriad of the vulva, one branch extending anteriad, the other posteriad. Anterior ovarian tube reaches 2.42 mm. anteriad of the vulva, and then loops posteriad for a distance of 1.019 mm. Posterior ovarian tube extends to a point 0.586 mm. from posterior extremity and then loops about and extends anteriad for a distance of 1.764 mm. Anus 0.06 mm. from posterior extremity. Tail characteristically very blunt, terminating in a spine-like process and usually bent back at an angle to the body (Fig. 4).

*Hysterothylacium cayugensis* Wigdor nov. spec.

A nematode found very commonly in the pike, *Esox lucius* L, and much less commonly in the bullhead, *Ameiurus nebulosus* (LeSueur), in the waters of Lake Cayuga, in all probability falls in the new genus described by Ward and Magath (1917) as *Hysterothylacium*. This is in the family Heterocheilidae which they characterize as follows: "Body without anterior tunic but with narrow lateral alae ("wings"). Lips three, not prominent. Esophagus arising from anterior end of



All figures are camera drawings. The reference line is 100 $\mu$  long in each case.

Fig. 1.—*Rhabdochona cascadilla*; A, Anterior extremity. B, Posterior extremity. C, Posterior extremity of male showing specules and papillae. D, Female, showing vulva, ovejector and divergent uteri.

intestine, directed posteriad." These workers have found the males only, the females being unknown, while the large number of specimens I have obtained are all unfertilized females.

*Hysterothylacium cayugensis* may be briefly characterized as follows: Length, 15 to 20 mm.; width, 0.14 to 0.19 mm. Three pairs of well-defined lips (Fig. 5). Head without anterior cuticular expansions. Esophagus long, averaging 2.35 mm. in length and 0.08 mm. in width. Distance of nerve ring from anterior extremity 0.21 mm. The esophagus is followed by what appears at first sight to be an

esophageal bulb, but on closer examination this seems to be a rotund dilation of the cecum which arises from the anterior portion of the intestine and extends posteriad as a cecum. This bulb-like expansion of the cecum is apparently glandular in nature, which would preclude the idea that this is an esophageal bulb. The expansion measures 0.128 mm. in diameter, while the cecum, including the dilation, is quite long, measuring 0.68 mm. in length and 0.026 mm. in width. Broad lateral alae (Fig. 6), width nearly one-fourth the diameter of the body, extend from base of lips to base of esophagus or farther. Body with marked transverse striations  $2\mu$  apart.

*Male* unknown.

*Female* with vulva in anterior portion of body, at a point approximately two-fifths of the length of body from the anterior end. Ovijector quite long, extending 0.549 mm. posteriad of the vulva. Uterus forks (Fig. 7) 0.588 mm. posteriad of the vulva to form two divergent uteri, one branch extending anteriorly, the other posteriad. Uteri long, looping transversely and diagonally (Fig. 8) through a large portion of the body cavity. Posterior ovarian tube extends to 0.14 mm. from the anus, which in turn lies 0.252 mm. from posterior extremity. Posterior extremity usually very acute.

Although this species has been placed in the genus *Hysterothylacium*, it differs essentially from Ward and Magath's description of the genus in the following particulars: There is no esophageal bulb, but a glandular rotund expansion of the cecum suggesting a bulb; and the cecum is quite long instead of short. In *H. brachyurum*, Ward and Magath's species, the cecum is approximately one thirty-third of the total length of the body; in *H. cayugensis*, Wigdor's species, it is approximately one twenty-fifth of the total length. The lips are well-defined in *H. cayugensis*. Ward and Magath (1916) state that the lips are not prominent in their species.

In assigning this species to the genus *Hysterothylacium*, the writer has assumed that in view of the features in common, it is possible that what Ward and Magath regard as an esophageal bulb, and what I regard as a proximal dilation of an intestinal cecum, are identical structures. If this assumption is correct, the two species are congeneric. Their specimens being all males and mine all females, the two might even have been regarded as identical species, if it were not for the fact that their males attained the size of 32 mm., while the largest of my females attained a maximum length of 20 mm. Since the female nematode is almost invariably larger than the male of the same species, this is excellent evidence of the specific distinctness of *H. cayugensis*. If, however, Ward and Magath are correct in their interpretation of the structure as an esophageal bulb, the form

described here must be transferred to another genus and may require the erection of a new genus.

Besides the mature worms, immature forms in the larval stage were obtained from the pike. They were 6 to 10 mm. in length and approximately 0.1 mm. in width, all of them as far as could be determined, being immature females.

Further studies on the minnows and small immature fish of Cayuga Lake disclosed forms which are undoubtedly the early larval stages of this worm. The presence of lateral alae, and a posteriorly directed intestinal cecum, with a spherical anterior expansion, and mouth parts bearing a strong resemblance to the mature form, shows that it is the same worm that reaches maturity in the pike and bullhead, after being ingested by the latter in eating the intermediate hosts. The host fishes

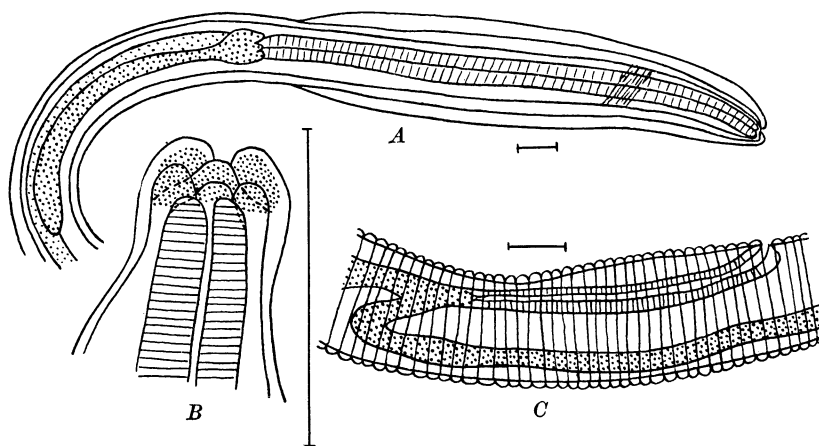


Fig. 2.—*Hysterothylacium cayugensis*; A, Anterior extremity showing lateral alae, esophagus, cecum and intestine. B, Anterior extremity showing lip arrangement. C, Female, showing vulva, ovejector and divergent uteri.

of this early immature stage are: golden shiner, *Abramis chrysoleucus* (Mitchell); satin-fin shiner, *Notropis whipplei* (Girard); blunt-nosed minnow, *Pimephales notatus* (Rafinesque); barred killifish, *Fundulus heteroclitus* (Linn); Cayuga minnow, *Notropis cayuga* (Meek); common sun-fish, or pumpkin-seed, *Eupometis gibbosus* (L), and the common white sucker, *Catostomus commersoni* (Lacépède).

The size of the forms in the various hosts are as follows:

	Length mm.	Width mm.
Barred killifish .....	1.80 to 3.10	0.064 to 0.082
Blunt-nosed minnow .....	1.71 to 4.40	0.051 to 0.124
Cayuga minnow .....	1.65 to 3.10	0.048 to 0.082
Golden shiner .....	1.09 to 1.94	0.053 to 0.070
Satin-fin shiner .....	1.38 to 2.12	0.048 to 0.072
Sucker .....	1.16 to 2.09	0.048 to 0.072

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